Climate smart strategies to strengthen coffee farmers adaptive capacity to climate change

Asayehegn Kinfe[1], Temple Ludovic[2], Iglesias Ana[3], Pedelahore Philippe[4] and Triomphe Bernard[2]

[1]*Montpellier SupAgro, France and Universidad Politécnica de Madrid, Spain*
[2]*Cirad(UMR Innovation), Montpellier, France*
[3]*Universidad Politécnica de Madrid, Spain*
[4]*ICRAF, Nairobi, Kenya*

Abstract

Adaptation of the agricultural sector to climate change(CC) is a main concern for the scientific and farmers'. Farmers and scientists perceive CC and adaptation needs differently. This work explores:

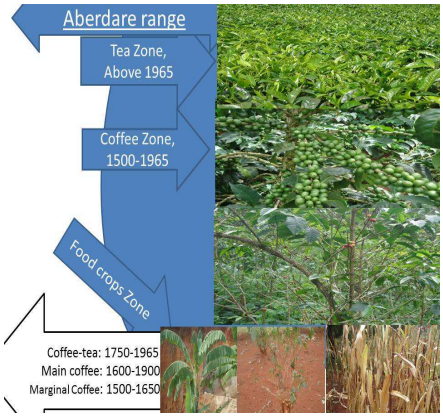
1) The views of scientists and farmers on adaptation needs.
2) Farmers' perception of CC, farm level adaptation strategies and the implications of climate smart agricultural practices (CSAPs) on household income.

The results show:

- Farmers' adaptation depends on their perception of the occurrence of CC, the need for adaptation, and the potential benefits for implementing new production strategies.
- Adoption of complementary multiple strategies have a higher payoff/return over adoption of particular adaptation strategies in isolation.

1. Introduction

- Coffee production in Kenya has declined by almost 65% in the last 30 years, and as much as 5 times in Murang'a County, a major coffee producing area. At the same time, coffee has moved up: whereas it was grown at altitudes of 1200-1500 m until 1980s, today it is grown at altitudes above 1500m, and between 1600-1900m for optimal production. lower altitude coffee area is converted to food crops and in the mid altitude potential coffee area, diversification to dairy is becoming common.



2. Methods

1. 120 farmers equally stratified to food crop and coffee production were interviewed about their perception of climate change. Consequently, 84.2 and 36.7 percent observed extended drought and extended cooler seasons respectively while 88.3 and 89.2 percent perceived changes on onset and cessation of RF respectively.
2. Official rainfall and temperature records for Murang'a were collected and analyzed for trends over the 1980-2012 period.
3. CSAPs adopted by farmers and their impact on household income is explored. Coffee farmers and food crop farmers are found to have different strategies to adapt CC.

3. Results

a) Farmers' Perception of CC (Table 1)

Perceived changes	Coffee zone		Food crop zone		Total		χ^2
	Freq.	%	Freq.	%	Freq.	%	
Extended warmer seasons	48	80	56	93.3	104	86.7	4.615**
Extended drought	44	73.3	57	95	101	84.2	10.568***
Extended cooler season	32	53.3	12	20	44	36.7	14.354***
Change in onset of RF	51	85	55	91.6	106	88.3	1.294
Changes in cessation of RF	51	85	56	93.3	107	89.2	2.157
Changes in duration of RF	48	80	56	93.3	104	86.7	4.615**
Changes in intensity of RF	50	83.3	56	93.3	106	88.3	2.911*
Changes in frequency RF	50	83.3	56	93.3	106	88.3	2.911*
Inter annual variability RF	48	80	56	93.3	104	86.7	4.615**
Predictability of RF	49	81.6	56	93.3	105	87.5	3.733*

*<0.1, **<0.05, ***, 0.01, RF=Rainfall

- Food crop and coffee farmers perceive climate change differently.
- The analysis of farmers perception indicates climate change (patterns of rainfall and variability of temperature) is higher in the lower altitude food crops zone except observation of extended cooler seasons than in the upper altitude coffee zone(Table 1).

b) Observed changes in annual temperature and rainfall (1980-2012)

Figure 2: Annual temperature difference in Celsius

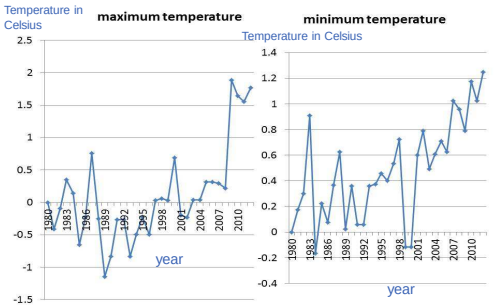
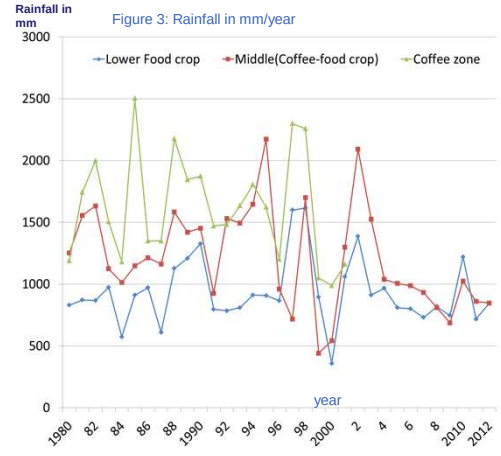


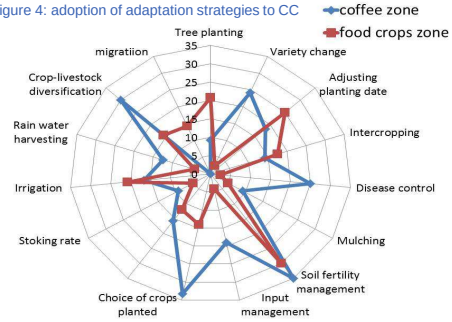
Figure 3: Rainfall in mm/year



- Maximum and minimum temperature increased by 1.76 ºC and 1.25 ºC (figure 2) between 1980 and 2012 respectively, and are projected to increase further by 1 ºC and 2.3 ºC by 2020 and by 2050 (CIAT, 2010). Such increase is in line with farmers' perception of CC (see Table 1).
- Measured annual rainfall(RF) (figure 3) decreased slightly over 1980-2012 periods. This contrasts with farmers' perceptions that RF decreased significantly over the last decades. The change perceived by the farmers, but not confirmed by the scientists could be a change in RF pattern(onset, cessation, frequency, intensity, or seasonality of RF)

c) Adaptation: Climate smart practices

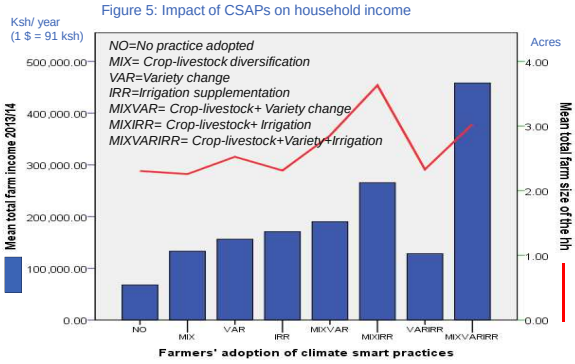
Figure 4: adoption of adaptation strategies to CC



- Farmers adopt a range of adaptation strategies in response to perceived CC(figure 4).
- Crop management strategies such as changing varieties, choices of crops, input management and diseases controlling are mostly practiced by coffee farmers (figure 4).
- tree planting and shed management, adjusting planting dates, irrigation and migration are mostly practiced in the lower altitude food crops

d) Effects of climate smart practices on household income

Figure 5: Impact of CSAPs on household income



- Non-adopters of strategies are found to have less annual income by 60,565.25*Ksh* compare to adopters .
- irrigation adoption yields higher income followed by varietal change and mixed crop-livestock diversification respectively among adoption of single strategies in isolation.
- Farmers adopted all the three strategies (MIXVARIRR) have better income than single strategy adopters, for instance are more wealthier by 325,255.82 and 287,340.70Ksh compare to crop-livestock and irrigation adoption in isolation.

4. Conclusion

- Farmers overestimate the decline in rainfall; probably since rainfall is a key factor for optimal harvest and is affected more by pattern which is less considered by scientists.
- Adoption of multiple adaptation strategies increases total farm income. Simultaneous adoption of crop-livestock diversification, changing varieties and irrigation provides the highest payoff in compare the other strategies in isolation and combination.
- The next steps of research will include analysis of suitable location of coffee areas taking into account CSAPs.

Acknowledgements

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